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## REVIEWS

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*Ueber Erythrosuchus, Vertreter der neuen Reptilordnung Pelycosimia.* By F. VON HUENE. Geologische und paleontologische Abhandlungen, X (1911). Pp. 58; plates 11.

The genus *Erythrosuchus* was described five years ago by Dr. R. Broom, from the Triassic of South Africa; it was referred by him to the Phytosauria, from which it differs especially in having terminal nares and short premaxillae. Dr. Heune, after a careful study of the known remains of the genus, reaches, in the above-cited paper, the startling conclusion that the genus represents a new order of reptiles allied to the Pelycosauria; that is, that it is a branch from the root-stem of that group ("Zweig von der Wurzel der Pelycosaurien"). Aside from the differential characters already mentioned, *Erythrosuchus* differs from the phytosaurs chiefly in the structure of the limbs, which seem to resemble more those of the pelycosaurs and other primitive reptiles. The skull, as Huene admits, has "viele und auffallende Übereinstimmungen mit den Phytosaurien," in its two temporal vacuities, the absence of additional temporal bones, antorbital vacuities, etc. The vertebrae also, are of the archosaurian type, differing especially from those of the Pelycosauria in the shallow concavities of their centra, the absence of intercentra, and especially in the articulation of the dorsal ribs. It is an important fact, which the author does not seem to appreciate, that the mode of rib articulation is highly characteristic of the reptilian orders. It may be set down as a fundamental taxonomic principle that no related groups of reptiles, or other vertebrates differ materially in the way in which the dorsal ribs articulate with their vertebrae. All the archosaurian reptiles are alike in this respect—double-headed ribs articulating with the diapophyses of the arches exclusively, at least posteriorly—a character found in no other vertebrates. And this is the condition in *Erythrosuchus*, a character in itself sufficient to fix its position among the Archosauria, and by Archosauria I mean the Crocodilia, Dinosauria, Pterosauria, and Parasuchia. The Sauropterygia, it is true, also have the dorsal ribs attached exclusively to the diapophyses, but the ribs show no division into capitulum and tuberculum, differentiating the order sharply. Under the Sauropterygia I include only the Nothodontia and Plesiosauria—the Mesosauria, which are sometimes included in the order,

belong, I am satisfied, with the Theromorpha. The Pelycosauria, like other primitive reptiles, have the ribs attached invariably to the inter-central space and the diapophysis; that is, they are double-headed throughout, while the Cotylosauria, with like attachments, may have the articulation continuous from head to tubercle.

In the pectoral girdle about all the difference that *Erythrosuchus* presents from the phytosaurs is a distinct supracoracoid foramen—precisely the character that would be expected in the more primitive form; and the pelvis, while agreeing in the main with the phytosaurs, differs very materially from that of the pelycosaurs. The chief differences that the author finds allying the genus to the pelycosaurs, are, as stated, found in the limbs: "*Erythrosuchus* kann, trotz der vielen Ähnlichkeit überhaupt, kein Parasuchien sein, da das Femur besonders in der Bildung des Proximalendes mit den primitiven und älteren Pelycosaurien und Cotylosaurien . . . völlig übereinstimmt." Admitting this "complete agreement" of the proximal end of the femur between *Erythrosuchus* and the Pelycosauria and Cotylosauria, can one not conceive that the resemblances have been brought about by adaptation to like conditions, that the characters are adaptive and not genetic here, as so often elsewhere? But I do not admit this complete agreement. There is much variation in the femora of the cotylosaurs and pelycosaurs, as witness those of *Dimetrodon*, *Araucoscelis*, *Diadectes*, *Seymouria*, and *Labidosaurus*. The humerus of *Erythrosuchus*, although it has a large lateral process and greatly expanded ends, differs materially from that of the pelycosaurs and cotylosaurs in the absence of the entocondylar foramen. One does not refer the moles to a distinct order of mammals because of the differences in the humeri from other rodents.

The skull structure of *Erythrosuchus*, with its upper temporal and antorbital vacuities, is so much at variance with the theromorph reptiles, that I can see no possible evidence of genetic relationships between them. Unless Huene would make the Archosauria a part of the same branch, from the root of the Pelycosauria, he attempts to prove too much, for he would make the Pelycosimia a distinct branch or phylum of the reptilia and entitled to more than ordinal distinction. He classes the Pelycosauria with the single-arched reptiles and is correct in so doing, but I confess I am not quite clear as to the real distinctions between upper and lower temporal vacuities in such reptiles. Nor does Huene seem to be either, as witness the following quotations:

*Op. cit.* page 41, second paragraph: "Da bei *Deuterosaurus* das

Postorbitale den unteren Rand der einzigen Schläfenöffnung begrenzt, ist sie als die oberen aufzufassen, und sie sind, im Gegensatz zu den ebenfalls monozygocrotaphen Pelycosaurien und Therapsida als 'hypozygocrotaphen' zu bezeichnen."

Same page, fourth paragraph: "Alle Therapsida (mit warscheinlicher Ausnahme von *Cynognathus*) besitzen bekanntlich nur eine einzige Schläfenöffnung, *die der oberen entspricht* (italics mine). Darin und in der Form des Quadratoms stimmen sie alle mit den Deuterosaurien," etc.

Page 43, second paragraph: "Da die untere Schläfenöffnung nicht entwickelt, resp. nach unten nicht geschlossen ist, fehlt den Therapsiden das Quadratojugale," etc.

Same page, third paragraph: "Da bei den Therapsiden das Postorbitale und Postfrontale an der oberen Ecke der Schläfenöffnung liegen, ist letztere als untere Schläfenöffnung aufzufassen, die Therapsiden sind also katazygocrotaph."

From personal conversation with Dr. Huene I know that the last statement expresses his real views; but nevertheless the flat contradictions on these two pages indicate an unsettled opinion. As I have already stated (*American Permian Vertebrates*, p. 92) Broom has figured *Tapinocephalus* with the postorbital and squamosal in broad contact, but he nevertheless holds that the vacuity above them is the "lower" one. One must therefore wait for further light on the subject before accepting their views.

And there is much confusion also about the quadratojugal bone. It is known to occur in only one genus of the Therapsida, *Dinocephalus*, but both Broom and Huene insist that it is present in the Pelycosauria, and Broom has figured it in *Dimetrodon*. But, a study of the material in the University of Chicago—material in which this region is preserved most perfectly—enables me to say positively that there is no such suture or foramen in the lower arch as Broom gives. That a very small, vestigial quadratojugal bone may occur at the extreme posterior end of the jugal is possible, but I have never seen any satisfactory evidence of it, and I doubt its presence, as does also Professor Case.

In brief my own opinion is that Broom was quite right when he referred *Erythrosuchus* to the Phytosauria, using the term in a wide sense as a synonym of Parasuchia. In any event *Erythrosuchus* is an archosaurian reptile with no direct affinities with the Pelycosauria.

In expressing these differences of opinion I would in no wise deprecate the value of Dr. Huene's paper. It is a useful one and may be perused with profit.

In conclusion I wish to protest against the restoration Huene has made of my figure of the pelvis of *Eubrachiosaurus* Will. (p. 49). The outlines as I gave them are essentially correct, and the bones do *not* belong on the right side. As to the distinction of the genus from *Placerias* Lucas, I am, however, not so sure.

S. W. WILLISTON

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*The Monroe Formation of Southern Michigan and Adjoining Regions.*

By A. W. GRABAU AND W. H. SHERZER. [Michigan Geological and Biological Survey. Publication 2. Geological Series 1.]

This report describes a series of Paleozoic beds and their faunas which have their greatest development in southeastern Michigan and the adjacent portions of Ontario and Ohio. In the past these strata, which constitute the Monroe formation, have been much misunderstood, and their importance in the Paleozoic section of the region has been greatly underestimated. The maximum thickness of the formation is about 1,200 feet.

The Monroe as a whole is divided into two series of dolomitic beds, the Lower and Upper Monroe, separated by the Sylvania sandstones, a bed of exceptionally pure, white, and almost incoherent sand in its more typical development, but merging into arenaceous dolomites in its less typical expression. The maximum thickness of the Sylvania is 300 feet, and the peculiar nature of the formation is explained on the hypothesis that it is an aeolian deposit laid down under essentially desert conditions, the original source of the material being the exposures of the Saint Peter sandstone to the northwest in Wisconsin.

The Monroe faunas are described in detail and are illustrated by twenty-five plates; 126 species in all are defined, many of them new forms, and seven new genera are proposed. The faunas of the two divisions of the Monroe are shown to be essentially different, there being almost no species in common. The Lower Monroe faunas are all late Silurian in aspect, being more or less closely related to the Manilus and Rondout formations of eastern New York. In the lower divisions of the Upper Monroe a conspicuous coral element appears which was entirely lacking in the Lower Monroe faunas, and among these corals are many strikingly Devonian forms; among the brachiopods are found both Devonian and Silurian types; the pelecypods are Devonian while the gastropods and cephalopods are essentially Silurian in aspect.